FEDERAL - STATE - PRIVATE
COOPERATIVE SNOW SURVEYS

WATER SUPPLY OUTLOOK FOR WESTERN UNITED STATES

Including Columbia River Drainage in Canada

and

FEDERAL - STATE - PRIVATE COOPERATIVE SNOW SURVEYS

UNITED STATES DEPARTMENT of AGRICULTURE···SOIL CONSERVATION SERVICE
Collaborating with
CALIFORNIA DEPARTMENT of WATER RESOURCES
and
BRITISH COLUMBIA DEPARTMENT of
LANDS, FORESTS and WATER RESOURCES

AS OF
APR. 1, 1970

TO RECIPIENTS OF WATER SUPPLY OUTLOOK REPORTS:

Mast af the usable water in western states ariginates as mountain snawfall. This snawfall accumulates during the winter and spring, several manths befare the snaw melts and appeors as streamflaw. Since the runaff fram precipitatian as snaw is delayed, estimates of snowmelt runaff can be made well in advance af its accurrence. Streamflaw farecasts published in this repart are based principally on measurement af the water equivalent af the mauntain snowpack.

Forecasts became mare accurate as mare af the dota affecting runaff are measured. All farecasts assume that climatic factars during the remainder af the snow accumulatian and melt seasan will interact with a resultant average effect an runaff. Early seasan farecasts are therefare subject ta a greater change than thase made an later dates.

The snow course meosurement is abtained by sampling snaw depth and water equivalent ot surveyed and marked lacatians in mauntoin oreas. A tatal of obout ten samples are taken at each lacatian. The averoge of these are reparted as snow depth and water equivalent. These measurements are repeated in the same lacatian near the same dates each year.

Snow surveys are made manthly or semi-monthly from Janoory 1 thraugh June 1 in most states. There are about 1400 snaw caurses in Western United States and in the Calumbia Basin in British Calumbia. In the near future, it is anticipated that autamotic snaw water equivalent sensing devices alang with radia telemetry will provide a continuaus recard of snaw water equivalent at key locations.

Detailed data an snaw caurse and sail maisture measurements are presented in state and local reports. Other data an reservair starage, summaries af precipitatian, current streamflaw, and sail moisture canditions at valley elevatians are alsa included. The repart far Western United States presents a braad picture af water supply autlook canditians, including selected streamflaw farecasts, summary af snaw accumulatian ta date, and starage in larger reservairs.

Snaw survey and soil maisture data for the periad of record are published by the Sail Canservatian Service by states abaut every five years. Data far the current year is summarized in a West-wide basic data summary ond published about October 1 af each year.

PUBLISHED BY SOIL CONSERVATION SERVICE

The Soil Canservation Service publishes reparts fallawing the principal snaw survey dates from January 1 thraugh June 1 in cooperatian with state water administratars, agricultural experiment statians and others. Capies af the reports far Western United States and oll state reparts may be abtained fram Soil Canservatian Service, Western Regianal Technical Service Center, Raom 209, 701 N. W. Glisan, Partland, Oregan 97209.

Copies af state and lacal reparts may alsa be abtoined from state offices af the Sail Canservatian Service in the following states:

STATE	ADDRESS
Alaska	P. O. Bax "F", Polmer, Alaska 99645
Arizana	6029 Federal Building, Phaenix, Arizona 85025
Calarado (N. Mex.)	12417 Federal Building, Denver, Calorado 80202
Idaho	Raam 345, 304 N. 8th. St., Baise, Idoha 83702
Montana	P. O. Bax 98, Bazeman, Mantona 59715
Nevada	P. O. Box 4850, Reno Nevada 89505
Oregon	1218 S. W. Washingtan St., Partland, Oregon 97205
Utah	4012 Federal Building, Salt Lake City, Utah 84111
Woshingtan	360 U.S. Court House, Spakane, Washingtan 99201
Wyaming	P. O. Box 340, Casper, Wyaming 82601

PUBLISHED BY OTHER AGENCIES.

Water Supply Outlaok reparts prepared by ather agencies include a repart far California by the Water Supply Farecast and Snaw Surveys Unit, Califarnia Department af Water Resaurces, P O Bax 388, Sacramenta, California 95802 --- and far British Calumbia by the Department af Lands, Farests and Water Resaurces, Water Resaurces Service, Parliament Building, Victaria, British Columbia

USDA-SCS-PORTLAND, OREG 1966

WATER SUPPLY OUTLOOK FOR WESTERN UNITED STATES

Including Columbia River Drainage in Canada

ISSUED

APRIL 1, 1970

The Soil Conservation Service coordinates snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Corps of Engineers, Forest Service, National Park Service, Weather Bureau, Geological Survey, and other Federal Agencies, Departments of State Government, Irrigation Districts, Power Companies, and others.

The Department of Water Resources coordinates snow surveys in California.

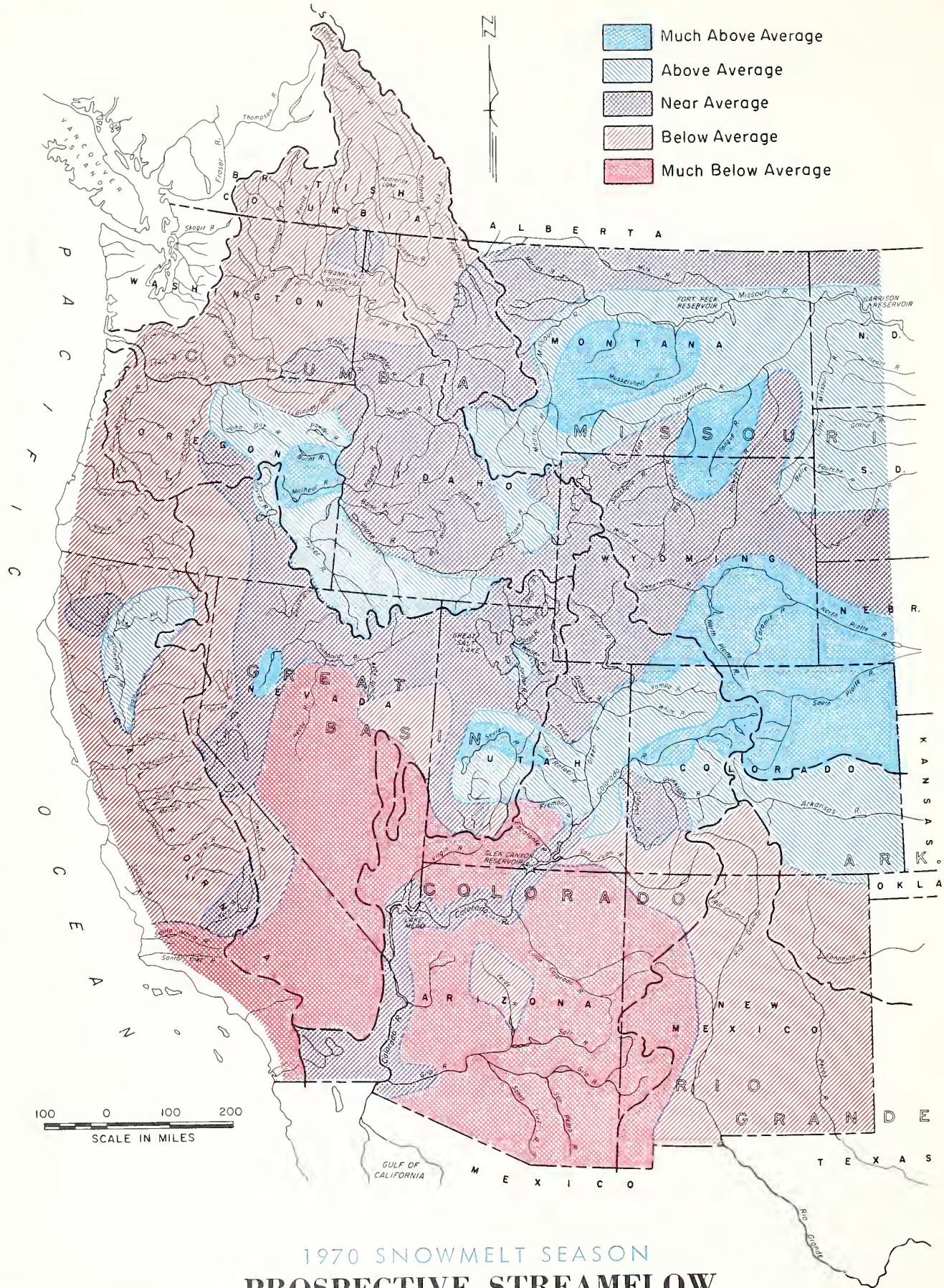
The Water Resources Service, Department of Lands, Forests, and Water Resources directs snow surveys in British Columbia.

This report was prepared by the Water Supply Forecasting Branch, Engineering Division, Soil Conservation Service, from data supplied by Snow Survey Supervisors of the Soil Conservation Service in the States of Alaska, Arizona, Colorado and New Mexico, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

Data from California was supplied by the Chief, Water Supply Forecast and Snow Survey Unit, Department of Water Resources.

Data from British Columbia was supplied by the Chief, Hydrology Division, Water Investigations Branch, Department of Lands, Forests and Water Resources.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KENNETH E. GRANT, ADMINISTRATOR



1970 SNOWMELT SEASON

PROSPECTIVE STREAMFLOW

AS OF APRIL 1, 1970

USDA SCS-PORTLAND, OREG 1968

WATER SUPPLY OUTLOOK

1970 SNOWMELT SEASON
AS OF APRIL 1, 1970

CURRENT STREAMFLOW PROSPECTS, WHEN ADDED TO A GENERALLY EXCELLENT RESERVOIR WATER SUPPLY, PROVIDE AN ADEQUATE OR CONSIDERABLY BETTER WATER OUTLOOK FOR ALL MAJOR IRRIGATED AREAS. SOME WATER USERS IN SMALLER IRRIGATED AREAS WHERE RESERVOIR STORAGE IS LIMITED OR NOT AVAILABLE MAY EXPERIENCE LATE SUMMER SHORTAGES IN THE FOLLOWING AREAS - ARIZONA, NEW MEXICO, SMALL AREAS OF SOUTHERN COLORADO, UTAH AND NEVADA, AND ALONG THE SIERRA - CASCADE RANGES.

March weather was generally dry along the coastal states and inland to near the Rocky mountains. Mountain snowfall was near average or considerably above along the Rocky mountains from near west central Montana southward thru Wyoming and Colorado. It was above average (near 150 percent) in eastern Utah. Another belt of heavy precipitation extended across southern areas. The South Coastal and Colorado desert areas of southern California received over 150 percent of average amounts. This heavy precipitation continued across all watersheds of Arizona except the Gila river. Precipitation was also above normal in New Mexico.

Although March weather resulted in a general lowering of streamflow prospects in the Great Basin, in northern and western sections of the Columbia Basin and in the Coastal states, water supplies are still expected to be adequate for nearly all normal uses.

The California Department of Water Resources reports continued reduction in forecasted runoff volumes for most streams in the State as a result of below normal precipitation and drying weather experienced in March. The April 1 snow surveys show that the low and midelevation snowpack was substantially below normal for this date. Streamflow during March was near normal and storage in the State's major reservoirs is above average in all areas. Overall - considering total available water in storage, both in reservoirs and the snowpack, the water conditions in the State are good and water users in most areas can expect near or normal supplies this spring.

The entire upper Columbia and Kootenai rivers in British Columbia have a very light snowpack, according to the British Columbia Department of Lands, Forests and Water Resources. Within the province the snow varies from a low of 62 percent average on the East Kootenai to 67 percent on the lower Columbia and near 85 percent on the Okanogan - Similkameen. Many snow courses on the Columbia and Kootenai either equaled previous record low readings or established new minimums. While no irrigation shortages are anticipated here, the impact of these lower than normal streamflows will be felt in the power reservoirs.

Below normal streamflow is also expected in extreme northwest Montana, parts of northern Idaho, central and western Oregon and most of Washington. Near 15 to 30 percent less than normal runoff is anticipated here. Except in Washington reservoir storage is generally good in these areas, assuring adequate supplemental water supplies to offset the low streamflow. In Washington reservoir storage is below average, but should be sufficient unless spring and summer months are dry.

Areas where much above normal streamflow (130 to 150 percent or more) is anticipated include the Judith, Musselshell, Smith and Gallatin rivers in west central Montana, the Little Big Horn and Tongue rivers along the Wyoming-Montana border, the North and South Platte rivers of Wyoming and Colorado, the Little Snake river in Wyoming, the upper Colorado river in Colorado and the Malheur and Burnt rivers in Oregon.

In the west central Montana area where snowpacks are maximum of record, snowmelt runoff this spring has the potential of exceeding the bank full stage, particularly if abnormally high melting rates or prolonged rainfall occurs.

Most Arizona streams should yield near half of normal amounts. In New Mexico, stream forecasts range from near 50 percent in the west to about 70 percent average on the Rio Grande and Pecos rivers. The San Juan river in Colorado, the Virgin and upper Sevier rivers in Utah and streams in central and

SUMMARY OF SNOW WATER EQUIVALENT MEASUREMENTS APRIL 1, 1970

MAJOR BASIN AND SUB—WATERSHED	WATER EQUIVALENT IN PERCENT OF: LAST YEAR	AVERAGE
MISSOURI BASIN		
Jefferson	87	113
Madison	86	110
Gallatin	143	140
Missouri Main Stem	114	119
Yellowstone	134	133
Shoshone	107	105
Wind	94	96
North Platte	137	140
South Platte	173	142
ARKANSAS BASIN		
Arkansas	142	132
Canadian	---	---
RIO GRANDE BASIN		
Rio Grande (Colo.)	58	73
Rio Grande abv. Otowi Bridge	56	87
Pecos	0	0
COLORADO BASIN		
Green (Wyo.)	95	99
Yampa - White	115	119
Duchesne	53	87
Price	61	100
Upper Colorado	141	135
Gunnison	86	111
San Juan	55	76
Dolores	70	122
Virgin	25	66
Gila	22	80
Salt	37	80
GREAT BASIN		
Bear	84	100
Logan	95	101
Ogden	68	97
Weber	71	100
Provo - Utah Lake	56	93
Jordan	79	107
Sevier	40	90
Walker - Carson	40	94
Tahoe - Truckee	43	85
Humboldt	49	110
Lake Co. (Oregon)	28	46
Harney Basin (Oregon)	66	109
UPPER COLUMBIA BASIN		
Columbia (Canada)	69	66
Kootenai	67	68
Clark Fork	85	95
Bitterroot	96	98
Flathead	108	110
Spokane	80	93
Okanogan	86	92
Methow	74	98
Chelan	63	76
Wenatchee	76	94

MAJOR BASIN AND SUB—WATERSHED	WATER EQUIVALENT IN PERCENT OF: LAST YEAR	AVERAGE
SNAKE BASIN		
Snake above Jackson, Wyo.	102	105
Snake above Hiese, Idaho	100	106
Snake abv. American Falls Res.	95	106
Henry's Fork	81	104
Southern Idaho Tributaries	105	125
Big and Little Wood	58	98
Boise	80	106
Owyhee	42	103
Payette	90	115
Malheur	88	128
Weiser	106	128
Burnt	108	127
Powder	106	120
Salmon	83	103
Grande Ronde	73	84
Clearwater	86	87
LOWER COLUMBIA BASIN		
Yakima	84	102
Umatilla	60	86
John Day	104	123
Deschutes - Crooked	65	77
Hood	56	77
Willamette	53	63
Lewis	57	67
Cowlitz	64	71
PACIFIC COASTAL BASIN		
Puget Sound	65	71
Olympic Peninsula	55	63
Umpqua - Rogue	35	57
Klamath	38	56
Trinity	45	80
CALIFORNIA CENTRAL VALLEY		
Upper Sacramento	50	85
Feather	40	80
Yuba	40	70
American	35	70
Mokelumne	35	75
Stanislaus	40	80
Tuolumne	35	75
Merced	35	75
San Joaquin	35	75
Kings	30	75
Kaweah	25	65
Tule	15	40
Kern	25	70

Data for California Watersheds supplied by Dept. of Water Resources, and for British Columbia Watersheds by Dept. of Lands, Forests and Water Resources.

Average is for 1953-67 *period.* California averages are for the period 1931-65.

Based on Selected Snow Courses determined by Distribution within the Basin, Length of Record and Repetitive Monthly Measurement Schedules.

southern Nevada should all produce near 60 to 70 percent of usual amounts.

In Arizona good water supplies are assured for the major irrigated areas, since reservoir storage is well above average. Reservoir storage is also good in New Mexico. In the drier areas noted above, shortages will be experienced in smaller areas where users are dependent on natural flow rights or have inadequate reservoir storage capacity.

MISSOURI BASIN

The mountain snowpack on the upper Missouri river and its tributaries in Montana shows considerable variability. It varies from near average on the Milk, Marias, Sun and Teton rivers to over 40 percent above average in the lower Gallatin, Judith, Shields, Smith, Belt and Musselshell rivers. In this latter area snowpacks are maximum of record. On the Jefferson, Madison and upper Gallatin rivers snow cover is about 10 to 15 percent above average.

On the Yellowstone river mountain snowfall was heavy during March, with the largest increases being noted in the Red Lodge area and on the northern part of the Big Horn mountains. The snowpack is now about a third above average. On the Shoshone and Wind rivers in Wyoming the snow cover has also improved since last month and is now essentially average. In the Big Horn mountains snow cover varies from near to well above average with the heaviest cover on the north and east slopes. This heavy snow cover is on the Little Big Horn and Tongue rivers.

Snow cover on the North and South Platte rivers in southern Wyoming and northern Colorado continues well above average - about 140 percent.

Flow of streams in Montana will be near or above average except along the lower Gallatin, Judith, Musselshell and adjacent drainages. In this area, snowmelt will keep streams bank full for much larger than the normal period. Abnormally high melting rates or prolonged rainfall during the usual spring high water period could cause streams to leave their banks. Reservoir regulation will be required to keep streams flowing at acceptable rates.

The Tongue and Little Big Horn rivers which head in Wyoming on the northern end of the Big Horn mountains will also produce heavy flows, yielding near 40 to 50 percent above average amounts.

In Wyoming the flow of the Clark Fork, Shoshone, Wind, Big Horn and Sweetwater rivers is anticipated to be about average. Smaller streams heading in the Black Hills of northeastern Wyoming should yield about 15 to 25 percent above their usual amounts.

Considerably above normal flows are also anticipated from Wyoming's North Platte and Laramie rivers, and from all tributaries of Colorado's South Platte. These streams will produce about 140 to 150 percent of normal.

Carryover reservoir storage is near normal in Montana, a little below average on the North Platte and Wind rivers in Wyoming, and above average in the reservoirs of the South Platte river system.

ARKANSAS BASIN

Reversing the trend of February, weather during March was considerably more favorable for producing a good water supply for next summer. Snowfall was particularly favorable on the main headwaters of the Arkansas river and its southern tributaries, the Cucharas and Purgatoire rivers. Snowpack here is now about a third above average. Mountain and valley soil moisture is good.

The Arkansas river at Salida, as well as the Cucharas and Purgatoire rivers are now expected to yield near 15 to 20 percent above average streamflow. Storage in John Martin reservoir is 14 percent of capacity, less than the 25 percent of capacity it usually holds at this time of year. However, this storage combined with the above normal runoff anticipated should furnish more than adequate water supplies.

March weather also brought improvement in the water outlook for the Canadian river. While flow of the river is still expected to be below average, its effect will be considerably offset by the excellent storage in Conchas reservoir. It now holds 85 percent of its capacity compared to the average condition of being 60 percent full.

RIO GRANDE BASIN

March snows were greater than usual, bringing improvement to the water outlook picture. However, in spite of improvement the mountain snowpack is still about 15 to 25 percent less than normal. The snowpack is nearest normal in Colorado and decreases to the south in New Mexico. Snows have mostly melted on the watersheds of the Pecos river.

Flow of the Rio Grande near Del Norte is expected to be about 80 percent of average. Inflow to the river system from the Conejos river near Mogote and the Chama river at El Vado reservoir should be near 70 percent average. Total flow of the Rio Grande at Otowi Bridge is forecast at 68 percent. Outlook for the Pecos river is essentially the same.

Storage in Elephant Butte reservoir is excellent. The reservoir holds 155 percent of its usual amount for this time of year. Any shortages experienced will be confined to areas

SELECTED STREAMFLOW FORECASTS (Thousand Acre Feet) APRIL-SEPTEMBER as of APRIL 1, 1970

STREAM and STATION	Forecast This Year		Last Year's Flow
	Flow	Percent of Average	
UPPER MISSOURI			
Jefferson at Sappington, Montana	1080	114	
Madison near Grayling, Montana 1/	452	105	573
Gallatin near Gateway, Montana	605	131	
Missouri near Landusky, Montana 2/	5350	120	
Sun at Gibson Dam, Montana 3/	600	99	509
Marias near Shelby, Montana 4/	550	91	476
Milk near Eastern Crossing, Montana	256	98	
Yellowstone at Yellowstone Lake Outlet, Wyo. (Apr-Oct.)	836	100	
Yellowstone at Corwin Springs, Montana	2150	114	2091
Clark Fork at Chance, Montana	635	109	
Shoshone, Inflow to Buffalo Bill Res., Wyo.	852	105	
Wind at Dubois, Wyoming	104	105	
Boysen Reservoir Inflow, Wyo.	766	103	
Bull Lake near Lenore, Wyoming	174	98	
Tensleep near Tensleep, Wyoming	72	97	
Yellowstone at Miles City, Montana 5/	6670	114	
Missouri near Williston, N. Dakota 6/	12800	116	
PLATTE			
North Platte at Saratoga, Wyoming	850	153	
Laramie near Jelm, Wyoming 7/	149	143	
Clear at Golden, Colorado	175	147	
St. Vrain at Lyons, Colorado	100	143	
Cache LaPoudre near Fort Collins, Colorado 8/	290	135	
ARKANSAS			
Arkansas at Salida, Colorado 9/	360	117	
Purgatoire at Trinidad, Colorado	55	120	
RIO GRANDE			
Rio Grande near Del Norte, Colorado 10/	350	80	
Conejos near Mogote, Colorado 11/	125	69	
El Vado Res. Inflow, New Mex.	135	72	
Rio Grande at Otowi Bridge, New Mexico 12/	350	68	
Pecos at Pecos, New Mexico *	28	68	
UPPER COLORADO			
Granby Reservoir Inflow, Colorado 13/	290	132	
Colorado at Dotsero, Colorado 14/	1800	131	
Roaring Fork at Glenwood Springs, Colorado 15/	825	121	
Gunnison at Grand Junction, Colorado 16/	1375	121	
Dolores at Dolores, Colorado	200	87	
Colorado near Cisco, Utah 16/ **	3468	124	3359
Flaming Gorge Res., Utah, Net Inflow 17/ **	1098	104	1273
Yampa at Steamboat Springs, Colorado	315	121	
Yampa near Maybell, Colorado	1000	117	
Little Snake nr. Dixon, Wyoming	388	150	
White near Meeker, Colorado	350	119	
Duchesne near Tabiona, Utah 18/ **	92	98	138
Whiterocks near Whiterocks, Utah **	40	90	73
Scofield Reservoir, Utah, Net Inflow 19/ **	33	103	60
Green at Green River, Utah 17/ **	2916	113	3404
Navajo Reservoir Inflow, New Mexico **	420	68	897
Animas at Durango, Colorado	350	86	
San Juan near Bluff, Utah 20/ **	626	70	1373
Colorado, Inflow to Lake Powell, Arizona 21/ **	7214	110	8162
LOWER COLORADO			
Gila near Solomon, Arizona (April-May)	17.5	51	21.5
Salt at Intake, Arizona (April-May)	70	58	206
Verde above Horseshoe Dam, Arizona (April-May)	35	70	64

SELECTED STREAMFLOW FORECASTS (Thousand Acre Feet) APRIL-SEPTEMBER as of APRIL 1, 1970

STREAM and STATION	Forecast This Year		Last Year's Flow
	Flow	Percent of Average	
GREAT BASIN			
Bear at Harer, Idaho	200	88	319
Logan near Logan, Utah 22/ **	102	103	111
Ogden, Inflow to Pine View Res., Utah 23/ **	90	96	155
Weber near Oakley, Utah **	100	95	146
Utah Lake, Utah, Net Inflow **	210	108	263
Big Cottonwood near Salt Lake City, Utah **	34	100	44
Beaver near Beaver, Utah **	23	122	36
Sevier near Hatch, Utah **	25	76	107
Sevier near Gunnison, Utah **	45	145	109
Humboldt at Palisades, Nevada **	177	115	363
Truckee at Farad, California 26/ **	210	81	557
East Carson near Gardnerville, Nevada **	160	91	394
West Walker near Coleville, California **	150	105	295
UPPER COLUMBIA			
Kootenai at Libby, Montana	6400	80	9168
Kootenai at Leonia, Idaho	7160	78	10672
Blackfoot near Bonner, Montana	980	97	1079
Flathead near Columbia Falls, Montana 27/	6230	96	5744
Flathead near Polson, Montana 27/	7240	94	7296
Clark Fork above Missoula, Montana	1750	99	1968
Bitterroot near Darby, Montana	540	97	566
Clark Fork at Plains, Montana 27/	11600	93	12388
Columbia at Birchbank, British Columbia 27/	37000	80	49744
Spokane at Post Falls, Idaho 28/	2500	80	3440
Columbia at Grand Coulee, Washington 27/	57800	83	74687
Okanogan near Tonasket, Washington	1400	81	
Chelan at Chelan, Washington 29/	1010	80	
Wenatchee at Peshastin, Washington	1600	88	
SNAKE			
Snake above Palisades Res., Wyoming 30/	2558	100	
Grey's above Palisade	387	107	
Salt above Palisade	340	106	
Snake near Heise, Idaho 30/ July)	3600	96	3685
Henry's Fork near Rexburg, Idaho 31/	1230	100	
Teton near St. Anthony	410	104	
Big Lost near Mackay, Idaho 32/	180	92	284
Big Wood, Inflow to Magic Res., Idaho 33/	270	103	625
Salmon Falls Creek nr San Jacinto, Idaho (March-September)	90	129	102
Bruneau near Hot Springs, Idaho (March-September)	235	123	274
Owyhee Res., Net Inflow, Oregon	350	117	741
Boise near Boise, Idaho 34/	1750	112	1987
Malheur near Drewsey, Oregon	99	138	103
Payette near Horseshoe Bend, Idaho 35/	2000	109	2086
Snake at Weiser, Idaho	6600	105	
Salmon at Whitebird, Idaho	7000	102	7230
Clearwater at Spalding, Idaho	8000	93	8380
LOWER COLUMBIA			
Grande Ronde at LaGrande, Oregon	144	82	227
Yakima at CleElum, Washington 36/	775	80	
Deschutes at Benham Falls, Oregon 37/	470	79	514
Columbia at The Dalles, Oregon 27/	90800	86	108959
Hood near Hood River, Oregon 37/	285	85	
Willamette at Salem, Oregon 37/	4130	79	
Lewis at Ariel, Washington 38/	1130	83	
Cowlitz at Castle Rock, Washington	2360	84	

SELECTED STREAMFLOW FORECASTS (Thousand Acre Feet) APRIL-SEPTEMBER as of APRIL 1, 1970

STREAM and STATION	Forecast This Year		Last Year's Flow
	Flow	Percent of Average	
NORTH PACIFIC COASTAL			
Dungeness near Sequim, Washington	130	76	
Rogue at Raygold, Oregon	765	81	1003
Klamath Lake, Net Inflow, Oregon	465	81	656
CALIFORNIA CENTRAL VALLEY 39/ **			
Sacramento, Inflow to Shasta, California	1980	113	2588
Feather near Oroville, California	1580	85	3307
Yuba at Smartville, California	880	81	1748
American, Inflow to Folsom Res., Calif.	1040	78	2191
Cosumnes at Michigan Bar, California	100	78	230
Mokelumne, Inflow to Pardee Res., Calif.	400	86	882
Stanislaus, Inflow to Melones Res., Calif.	600	84	1392
Tuolumne, Inflow to Don Pedro Res., Calif.	1080	92	2405
Merced, Inflow to Exchequer Res., Calif.	520	87	1379
San Joaquin, Inflow to Millerton Lake, Calif.	1030	88	2898
Kings, Inflow to Pine Flat Res., California	1000	87	3163
Kaweah, Inflow to Terminus Res., California	170	65	807
Tule, Inflow to Success Res., California	40	71	222
Kern, Inflow to Isabella Res., California	380	93	1649

Forecasts in California provided by Department of Water Resources.
Average is for 1953-67 period except California. California is computed for 1916-65.
Forecasts assume average Effective Climatic Conditions from Date Through Snow Melt Season.

Explanatory Notes on Forecasts Listed on Inside Back Cover.
* *April - June Period* ** *April - July Period.*

above reservoirs or to water users who have limited storage rights. Shortages are not expected to be severe and will be largely confined to late summer months.

COLORADO BASIN

Wet March weather throughout much of the Colorado basin brought significant increases to the mountain snowpack, particularly in some of the major water producing areas of Colorado. The result is reflected in streamflow forecast percentages, most of which are now for flows to be 10 to 35 percent higher than forecast a month ago. The change in forecast for the April-July inflow to Lake Powell reflects the generally improved outlook for the whole Upper Colorado river. Last month the expected inflow was for 92 percent of the normal amount. Now the outlook is for inflow to be 110 percent.

The present snowpack in the Upper Colorado river basin varies from about two-thirds average on southern Utah's smaller tributaries and three-fourths average on the San Juan river, to essentially average on the Green river in Wyoming and to over a third above average on the main upper Colorado river in Colorado.

The improved water outlook assures most water users in the upper basin of good to excellent water supplies this summer. Minor late season shortages may develop along the San Juan river and in southern Utah on the Virgin and Paria rivers, depending partly on how wet or dry the spring and summer months are. Any shortages that develop will affect those water users who are on natural flow rights, or where reservoir storage is limited.

Storage in most irrigation reservoirs is still considerably above average. Storage in Lake Powell and other major reservoirs in the upper basin is 39 percent of capacity and 2,265,030 acre-feet more than last year at this time. Storage in Lake Mead is also up, with approximately 1,211,000 acre-feet more than in 1969. As noted above, snowmelt season inflow to Lake Powell (April-July period) is forecast at 7,214,000 acre-feet, or 110 percent of the 1953-67 average period. The forecast assumes no change in upstream reservoir storage.

Highest streamflow (percentagewise) expected in the upper basin is for the Little Snake near Dixon, Wyoming, forecast at 150 percent. Forecasts for the White, Yampa, upper Colorado and Gunnison are in the 120 to 130 percent range. Inflow to Flaming Gorge reservoir is expected to be average or slightly above. Inflow to the river system from the Duchesne and Dolores rivers will be about 10 to 15 percent less than

average, while the Price and San Rafael rivers will yield about average to 20 percent above average amounts. The San Juan river should supply about 30 percent below normal.

In Arizona good water supplies are assured for the major irrigated areas, with water coming from well above average reservoir stored supplies. Since most streams will yield near half of normal amounts, shortages will be experienced in smaller areas not having reservoir supplies to depend on. Considerable pumping of ground water will be required on the upper Gila river and on the San Carlos Project.

The Salt River Project reservoirs, presently containing 67 percent of capacity, are 24 percent above average for this date. San Carlos and Lake Pleasant are 42 and 73 percent above average, respectively. Lyman Reservoir, which has been rising steadily, now contains almost twice the normal amount. The Colorado river reservoirs contain 54 percent above the average amount of water.

Southern Nevada's snowpack continues very deficient. Late summer water shortages are expected here.

GREAT BASIN

The dry weather of February continued thru March, with most watersheds of the Great Basin showing below average snowpack accumulation during the month. In spite of this continued dry weather, the present snowpack lying on major watersheds is near average. Early winter snowpack buildup was enough above average to offset most of the adverse effect of the past two months.

Based on the prospective snowmelt runoff and the well above average reservoir storage supplies, the outlook for water supplies next summer is very good for all major irrigated areas.

As it was last month, the water outlook is less favorable for some of the smaller watersheds in central and southern Nevada, southern Utah and in Lake County, Oregon. Snow surveys in southern Nevada, on the Reese river in central Nevada, on the upper Sevier river in Utah and in Lake County, Oregon show a snowpack varying from about 25 to 60 percent average. In White Pine County, Nevada, snowpacks indicate streamflow will be near three-fourths normal. Late summer shortages can be expected in these areas.

Throughout the Basin the snowpack is more favorable at the higher elevations, with the lack of low snow reflecting the dry weather and early melting conditions of February and March. The current snowpack on watersheds of the Humboldt, Owyhee and Snake river drainages in Nevada is generally above average, although this is not readily apparent since the low elevation snow is essentially non-existent. The higher elevation snowpack is sufficient to indicate above average flows on the Humboldt and its tributaries. With Rye Patch reservoir filled to capacity, water users along the entire Humboldt should have a good water year.

Streamflow in the Tahoe-Truckee and Carson river watersheds is expected to be slightly below average this summer. However, reservoir storage is excellent on both of these river systems and assures excellent water supplies this summer. With Topaz and Bridgeport reservoirs filled to capacity and average streamflow expected, the entire Walker river system has an excellent outlook.

Although snow cover is light on the Sevier river above Piute reservoir, this undesirable condition is largely offset by average or above snowpacks on tributary watersheds of the middle and lower Sevier river, by above average base flows in the river and excellent reservoir storage. Streamflow forecasts for the middle and lower Sevier, including tributaries, ranges from about 10 to 50 percent above average. Combined storage in the Sevier river reservoirs is 221 percent of average.

The water supply outlook remains good for water users served by streams of central and northern Utah that drain into Great Salt Lake. This includes the Bear river and its tributaries in Utah, Idaho and Wyoming. Most of these streams are forecast to yield within about 15 percent of usual amounts. Reservoir storage is above average.

COLUMBIA BASIN

Snowfall during March was quite variable over the basin. Monthly increases to the snowpack were generally below average in central and western Washington and Oregon, on the watersheds of British Columbia and most areas of southern and southeastern Idaho. Above normal monthly increases occurred on the southern tributaries of the Flathead river, the upper Clark Fork above Missoula, the upper Clearwater and Salmon rivers.

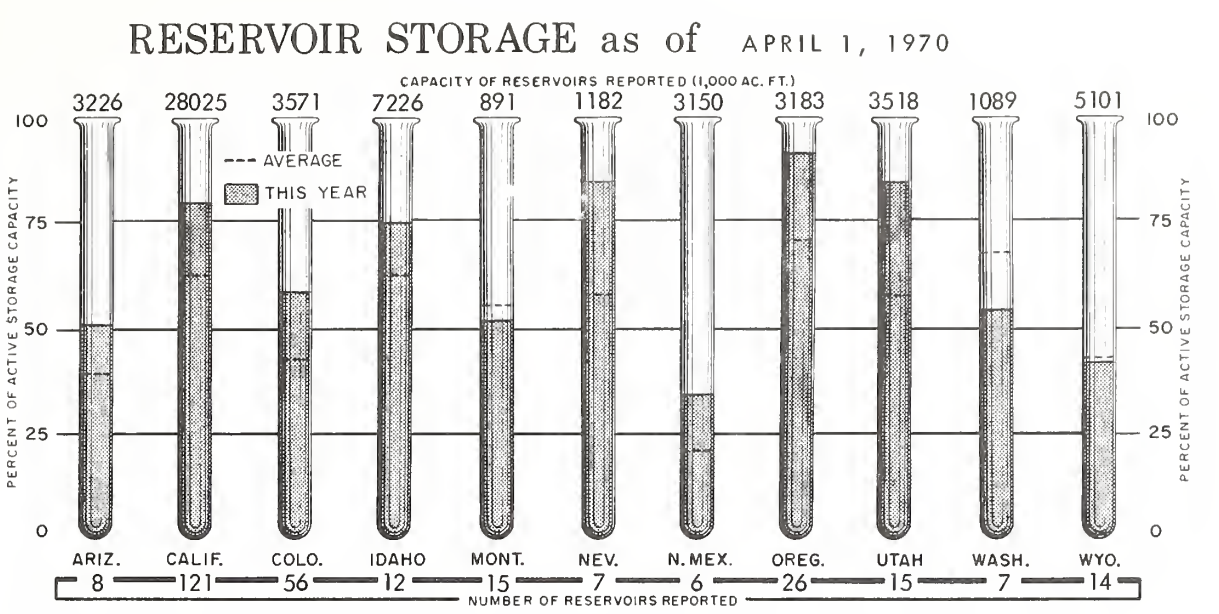
While near 15 to 30 percent less than normal runoff is anticipated for much of British Columbia, extreme northwest Montana, parts of northern Idaho, central and western Oregon and most of Washington, no major water shortages are anticipated as yet. Some late summer shortages may be experienced by water users dependent on natural streamflow. Except in Washington, reservoir storage is generally very favorable and will furnish adequate supplemental water supplies for most uses. In Washington reservoir storage is below average, but

STORAGE IN LARGE RESERVOIRS APRIL 1, 1970

BASIN AND NAME OF RESERVOIR	CAPACITY (1000 A.F.)	STORAGE (1000 A.F.)
UPPER MISSOURI		
Belle Fourche	185	113
Boysen	550	220
Buffalo Bill	373	125
Canyon Ferry	2043	1558
Fort Peck	19140	16200
Garrison	24500	18459
Hebgen	377	266
Keyhole	192	117
Lake Francis Case	5816	4329
Lake Sharp	1900	1721
Oahe	23630	18770
Tiber	1347	525
Yellowtail	1356	757
PLATTE		
City of Denver (5)	507	466
Colo-Big Thompson (3)	718	449
Glendo	784	435
Pathfinder	1016	316
Seminoe	1010	258
ARKANSAS		
Conchas	273	232
John Martin	354	51
RIO GRANDE		
Elephant Butte	2195	574
El Vado	195	1
UPPER COLORADO		
Blue Mesa	830	411
Flaming Gorge	3749	1484
Navajo	1696	859
Powell	25002	9535
LOWER COLORADO		
Havusu	619	543
Mead	26159	16597
Mohave	1810	1609
Salt River Res. (4)	1755	1266
San Carlos	985	168
Verde River Res. (2)	318	140
GREAT BASIN		
Bear	1421	1140
Lahontan	286	246
Rye Patch	179	181
Sevier Bridge	236	232
Strawberry	274	196
Tahoe	732	611
Utah	884	871
Willard Bay	193	141

BASIN AND NAME OF RESERVOIR	CAPACITY (1000 A.F.)	STORAGE (1000 A.F.)
UPPER COLUMBIA		
Chelan	676	22
Coeur d'Alene	225	134
Duncan	1347	43
Flathead	1219	154
Hungry Horse	2982	1548
Kootenay	673	0
Lower Arrow	3083	0
Noxon Rapids	335	183
Pend Oreille	1155	125
Roosevelt	5232	2111
Upper Arrow	4061	0
LOWER COLUMBIA		
Cougar	155	91
Detroit	300	217
Hills Creek	200	153
Lookout Point	337	199
Yakima Res. (5)	1066	574
SNAKE		
American Falls	1700	1710
Anderson Ranch	423	264
Arrowrock	287	278
Brownlee	980	471
Cascade	653	300
Jackson	847	630
Lucky Peak	278	109
Owyhee	715	698
Palisades	1200	989
PACIFIC COASTAL		
Clair Engle	2448	2435
Clear Lake	440	375
Nacimiento	350	141
Ross	1203	568
Upper Klamath	584	504
CALIFORNIA CENTRAL VALLEY		
Almanor	1036	927
Berryessa	1602	1604
Folsom	1010	614
Isabella	570	262
McClure	1026	708
Millerton	521	449
Oroville	3484	2938
Pine Flat	1013	804
Shasta	4500	3981

Reservoir Storage Data Provided by Bureau of Reclamation, Corps of Engineers, Geological Survey, and water using organizations. Data from California and British Columbia provided by Department of Water Resources and Department of Lands, Forests and Water Resources, respectively.



should prove to be sufficient unless spring and summer months are dry.

The entire upper Columbia and Kootenai rivers in British Columbia have a very light snowpack which varies from about 60 to 70 percent of normal. Many snow courses on the upper Columbia either equaled previous record low readings or established new minimums. Snow cover also varies from about 60 to 80 percent of average in Oregon's Cascade mountains, on the watersheds of Washington's Lewis, Cowlitz and Chelan rivers, and on the Palouse river.

Heavier snowpacks - 120 to 130 percent average - still lie on Oregon's upper John Day, Malheur, Burnt and Powder rivers. This condition extends to Idaho's Weiser, Payette and Teton rivers, as well as to the smaller streams of the Medicine Lodge, Camas and Beaver Creeks and the Blackfoot river. On Goose Creek and the Raft river in southern Idaho, snow cover is about 130 to 140 percent average.

Remaining areas of the basin have a snowpack which is generally within 15 percent of average.

Soil moisture under the higher elevation snowpacks continues generally below average. At middle elevations soils are saturated in most areas, while foothill and valley soils have begun drying out.

Most streams of British Columbia are expected to yield near 70 to 80 percent of average flows. Montana and Idaho's northern tributaries to the Kootenai and Columbia rivers are forecast to produce from about 80 percent to near average supplies.

Stream gaging stations along the main stem of the Snake river are expected to record essentially average flows this year. Outlook for tributary streams to the Snake river varies from about 5 to 10 percent below average on the Clearwater and Big Lost rivers to 30 to 40 percent above average on Oregon's Malheur and Burnt rivers. About 15 to 30 percent above average flows are anticipated from the southern tributaries to the river, including the Owyhee and Bruneau rivers as well as the smaller streams such as Salmon Falls Creek, Goose Creek and Raft river. Near average to 15 percent above average flows will come from the upper Snake and its tributaries in Wyoming, Henry's Fork and from middle Snake tributaries such as Big Wood, Boise, Payette and Salmon rivers. Other streams in Oregon where streamflow prospects are favorable - 10 to 30 percent above average - include the Powder and John Day rivers.

Near average flows should be realized from Oregon's Crooked river and from the Priest river in northern Idaho and the adjacent northeastern corner of Washington.

Most of the remaining areas of Washington and Oregon have a less favorable outlook, with most streams expected to yield near 20 percent less than average flows.

ALASKA

Snow cover throughout most of interior Alaska is the lowest for the period of record. Several snow courses in the Fairbanks area have less than half of the previous low.

The only major storms entering Alaska this winter came from the Gulf of Alaska. Snowfall has been heavy at the high elevations in the Chugach and Kenai Mountains because of these storms. However, less than normal amounts fell beyond these mountain ranges.

Soils are extremely dry in most of the state and much of the melting snow water will be absorbed directly into the ground. Runoff is expected to be unusually light in most of interior Alaska. The Kenai peninsula, on the other hand, has wet soils as a result of heavy fall rains. The deep snowpack in the mountains in this region should produce greater than average streamflow.

CALIFORNIA

The California Department of Water Resources, coordinating agency for snow surveys and water supply forecasting in California, reports that early, spring-like weather combined with below normal precipitation during March has significantly reduced California's spring and summer runoff potential. Forecasts of April-July runoff, based on April 1 snow surveys, are down as much as 20 percent from those reported one month ago and now indicate the State's snowmelt streams will produce about 90 percent of normal runoff for this period. Water stored in the State's major reservoirs as of April 1 was considerably above average for this date. Conditions in Southern California improved somewhat after experiencing above normal precipitation during March. Thus, despite the lower streamflow forecasts, water users in most areas of California can expect adequate water supplies.

Despite a good beginning, March produced only fair precipitation over the State, the monthly total being about 80 percent of normal. As during the previous month, the greater precipitation percentage-wise during March fell in the southern part of the State with the South Coastal and Colorado Desert areas receiving 155 and 160 percent of normal, respectively. To the north, Central Valley watersheds fared the best averaging about 80 percent of normal. The only general storm during March was the moderate to heavy system that became entrenched over the State on the last day of February. This persisted through the 5th bringing moderate to heavy precipitation to all areas. After a clear day, a weaker storm followed which was generally restricted to mountainous regions of Northern and Central California. From the 14th on, clear skies accompanied by moderate to strong northerly winds promoted an early spring and rapid depletion of the surface soil moisture. Seasonal precipitation to date for California is 110 percent of normal. This is distributed from normal to well above in the northern half of the State while the south is only about 70 percent of normal.

Snowpack measurements were obtained at 311 snow courses and 21 snow sensors throughout California on or about April 1. Snowpack water content generally ranges from 65 to 95 percent of normal for major Sierra and Cascade watersheds, the only exception being the Tule River Basin which is only 11 percent of normal. Although on most watersheds there were high elevation snow courses with normal or above April 1 water content, snowpack depletion or meager amounts at lower elevation snow courses substantially lowered basin averages. The water content in the snowpack for the State was 75 percent of the April 1 average.

April-July runoff in snowmelt streams of the Central Valley is forecasted to be about 90 percent of average, assuming normal precipitation during the remainder of the season. Individual river basins vary from a low of 67 percent of average for the Kaweah River Basin in the San Joaquin Valley to a high of 114 percent of average for the inflow to Shasta Reservoir in the Sacramento Valley. The influence of the early spring-like weather and low March precipitation was most apparent in the American and Tahoe watersheds where there was about a 20 percent reduction in the forecasts of one month ago. To the south, forecasts for the Kern and Kings River Basins are essentially unchanged. Total water year runoff in the State's streams will be about 140 percent of average with below normal amounts occurring only in the Central and South Coastal areas which are expected to have 90 percent of average runoff.

March runoff for California was about average reflecting the early spring-like conditions. Only the North Coastal area experienced below normal March runoff and that was 90 percent of normal. Runoff for the October-March period was 185 percent of average, ranging from 205 percent of average for the Sacramento Valley to 85 percent of average for the South Coastal area.

As of April 1, 121 of California's major reservoirs were storing 22,220,000 acre-feet. This storage represents 79 percent of their aggregate capacity, 125 percent of their 10-year average, and a net gain of 3,650,000 acre-feet during the past year.

EXPLANATION of STREAMFLOW FORECASTS

All flows are observed flows except as adjusted for: 1/ Change in storage in Hebgen Lake. 2/ Change in storage in Canyon Ferry and Tiber reservoirs. 3/ Change in storage in Gibson Reservoir and measured diversions. 4/ Change in storage in Two Medicine, Four Horns and Lake Francis reservoirs. 5/ Change in storage in Boysen and Buffalo Bill reservoirs.

6/ Change in storage in Boysen, Buffalo Bill, Canyon Ferry, Tiber, and Fort Peck reservoirs. 7/ Plus diversions to Cache la Poudre. 8/ Minus diversions from North Platte, Laramie, and Colorado rivers plus measured diversions above station. 9/ Change in storage in Twin Lakes and Sugar Loaf reservoirs minus diversions from Colorado River. 10/ Change in storage in Rio Grande, Santa Maria, and Continental reservoirs.

11/ Change in storage in Platoro Reservoir. 12/ Change in storage in El Vado Reservoir. 13/ Change in storage in Granby Reservoir plus diversions to Cache la Poudre and through Adams Tunnel. 14/ Changes as indicated in (13) plus Moffat Tunnel diversion. 15/ Plus diversions to Arkansas River.

16/ Change in storage in Blue Mesa reservoir. 17/ Change in storage in Flaming Gorge, Fontenelle and Big Sandy reservoirs. 18/ Plus diversion through Duchesne Tunnel. 19/ Change in storage in Scofield Reservoir. 20/ Change in storage in Navaho Reservoir.

2 21/ (Lee's Ferry) Change in storage in Flaming Gorge, Navajo, Lake Powell and Big Sandy reservoirs. 22/ Plus Utah Power and Light Company tailrace and and Logan, Hyde Park, and Smithfield canals. 23/ (Inflow record computed by U. S. Bureau of Reclamation.) 24/ Plus diversion by Weber-Provo Canal and change in storage in Wanship Reservoir. 25/ Change in storage in Deer Creek Reservoir, minus diversions through Duchesne Tunnel and Weber-Provo Canal, plus diversion through Salt Lake City Aqueduct.

26/ Change of storage in Lake Tahoe and Boca Reservoir. (Forecast by Truckee Basin Committee) 27/ Change in storage in any of these reservoirs above the station: Kootenai Lake, Hungry Horse, Flathead Lake, Pend Oreille Lake, F. D. Roosevelt Lake, Lake Chelan, Coeur d'Alene Lake, Brownlee and Noxon; and pumpage at Roosevelt Lake. 28/ Changes in storage in Coeur d'Alene Lake and diversions by Spokane Valley Farms Company and Rathdrum Prairie canals. 29/ Change in storage in Lake Chelan. 30/ Changes in storage for Jackson Lake and Palisades Reservoir above stations. 30/

31/ Change in storage in Henry's Lake, Island Park and Grassy Lake reservoirs and diversions between Ashton and Rexburg. 32/ Change in storage in Mackay Reservoir, and diversion in Sharp Ditch. 33/ (Combined flow Big Wood River nr. Bellevue and Camas Creek nr. Blaine.) 34/ Change in storage in Arrowrock, Anderson Ranch, and Lucky Peak. 35/ Change in storage in Cascade and Deadwood reservoirs. 36/ Change in storage in Keechelus, Kachess, and Cle Elum reservoirs plus diversion by Kittitas Canal. 37/ (Corrected to natural flow). 38/ Change in storage in Merwin, Yale, and Swift reservoirs. 39/ (Corrected for upstream impairments).

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